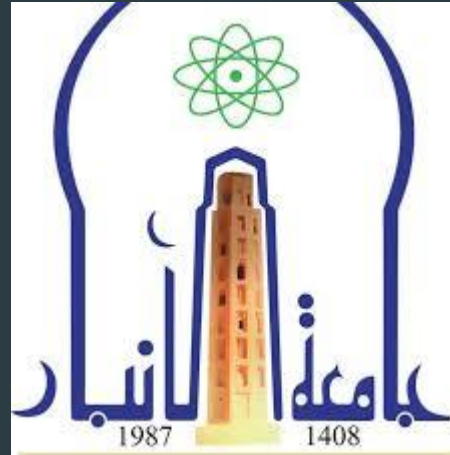


University of Anbar

Collage of Science

Department of Geology

Minerals / 1<sup>st</sup> stage.



# Mineral chemistry

Assistant lecture

Nazar Zaidan Khalaf

# Mineral chemistry

- **Matter**: take up a space and have mass
- The state of matter changes as you add more energy
- there are three state for the matter

1-solid state    2-liquid state    3-gases state

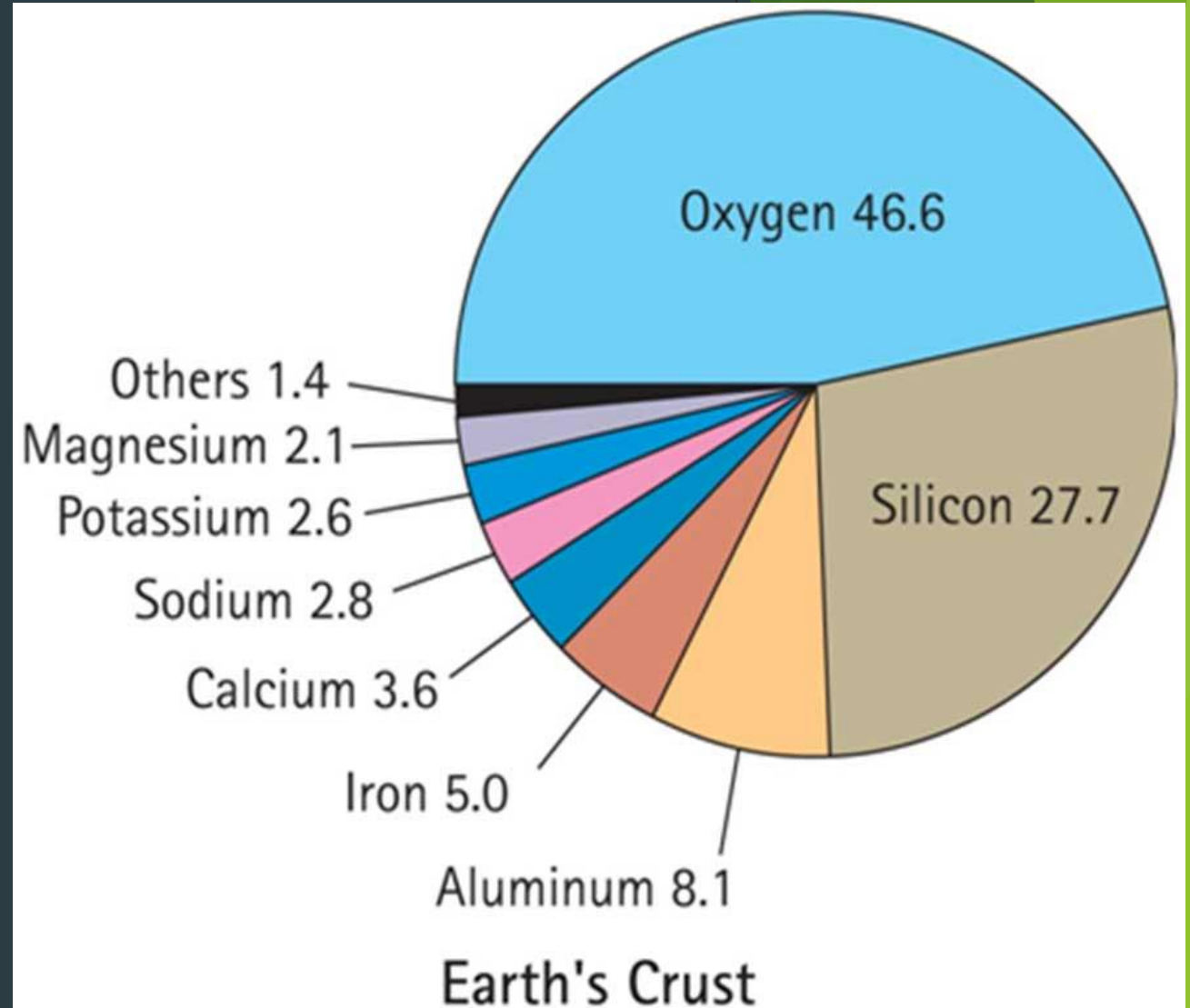


# *Composition of minerals*

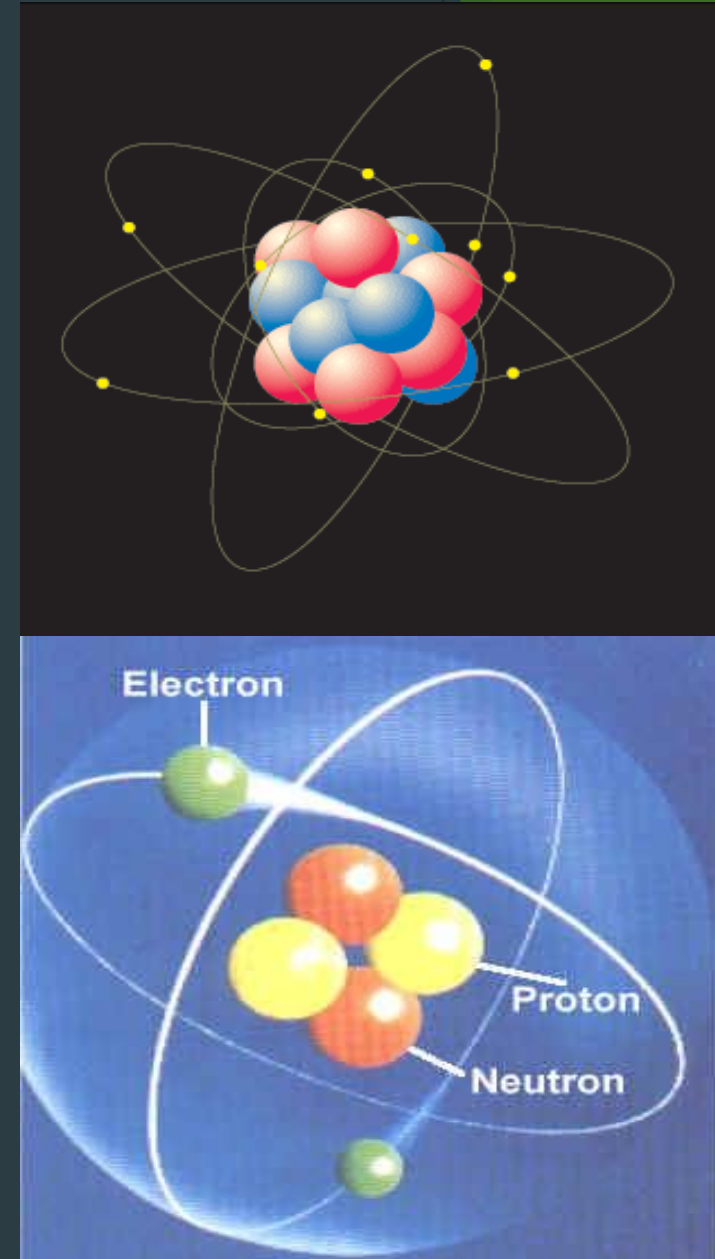
- Elements
  - Basic building blocks of minerals
  - Over 100 are known (92 naturally occurring)
- Atoms
  - Smallest particles of matter
  - Retains all the characteristics of an element

Nearly 4000 minerals have been named but only few dozen rock forming mineral common minerals that make up most of the earth crust, composed mainly of the eight elements that make up most of the continental crust.

O: Oxygen=46.6%, Si: Silicon= 27.7%, Al: Aluminum 8.1% Fe Iron=5%, Ca: Calcium= 3.6 % Na: Sodium=2.8% K: Potassium=2.6%, Mg: Magnesium 2.1% and Others 1.4%



- ▶ **An element** is a substance that cannot be broken down into simpler substances by chemical or physical means
- ▶ **Elements:** a group of the same kind of atoms
- **Atom**-The smallest particle of matter that contains the characteristics of an element.
- Parts of an Atom:
  - Neutron
  - Proton
  - Electron



## ▶ *minerals*

▶ The building blocks of minerals are elements

▶ **Atom**: smallest particles of matter that cannot be chemically split.

▶ **Proton**: charge of +1 and a mass of +1

▶ **Neutron**: charge of 0 and a mass of +1

▶ **Electron**: charge of -1 and no mass

- Electron exist as a cloud of negative charge surrounding the nucleus of proton and neutrons called **shells**.

- The outer most shell contains valence electron, which interact with other atoms other atoms to produce chemical bonds.

# PROTONS AND NEUTRONS

- • **Protons**

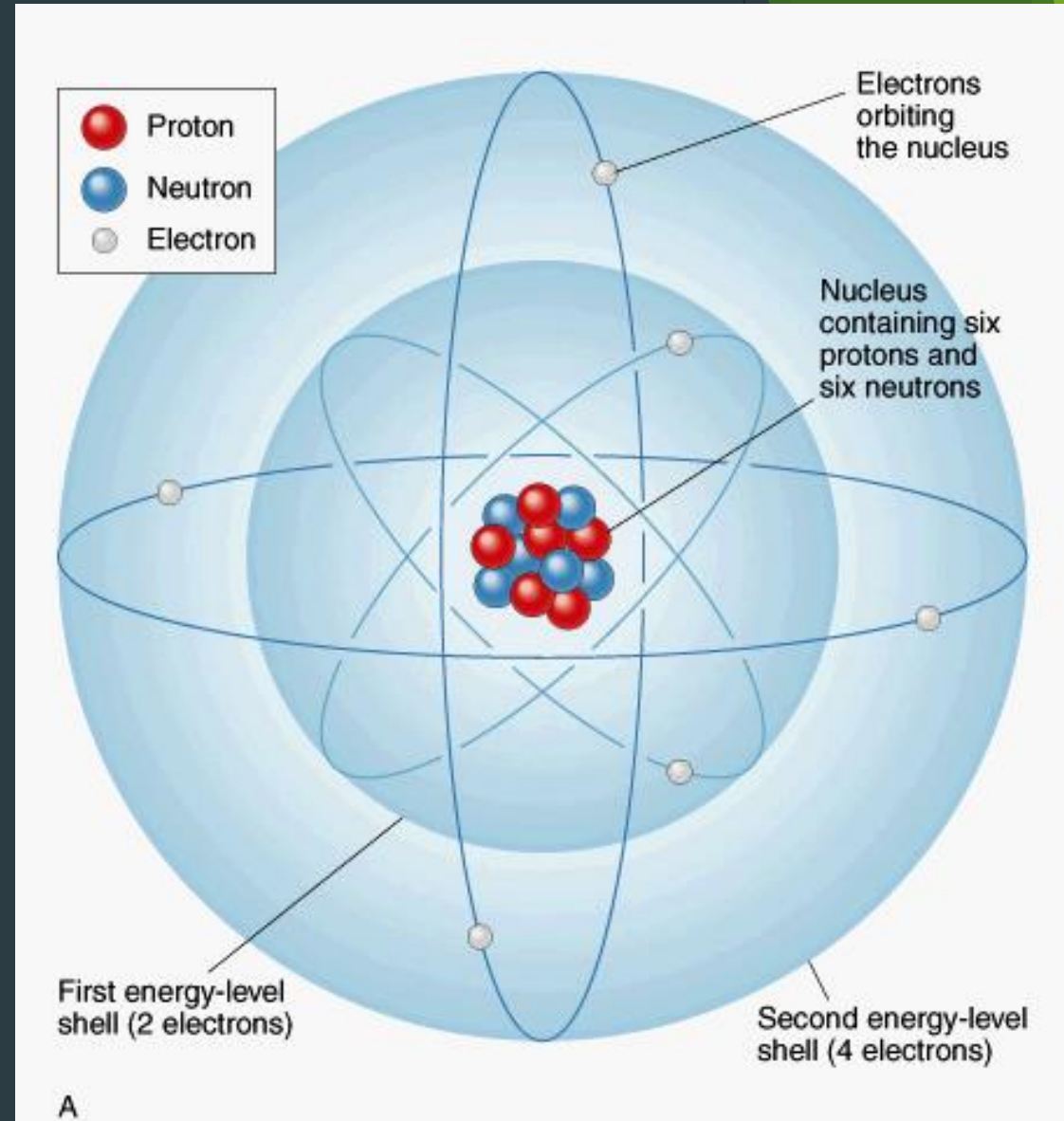
- Positively Charged
- Found in the nucleus.
- # of protons=atomic number

- **Neutron**

- No charge
- Found in the nucleus.
- Has the same mass as protons.

# Structure of an Atom

- ▶ Nucleus
- ▶ Proton
- ▶ Neutron
- ▶ Electron





- ▶ **Atomic number:** the number of protons in the nucleus of an atom
- ▶ Neutral atoms have the same number of electrons and protons
- ▶ **Atomic mass:** the total number of protons and neutron

6 → atomic number

C → element symbol

12.01 → atomic mass/ weight

▶ Same number of protons and electrons the atom is neutral

Ex. Carbon : 6 proton, 6 neutron and 6 electron

▶ More electron than protons , the atoms is negatively charged

Ex. Boron : 5 proton, 6 neutron, 6 electron

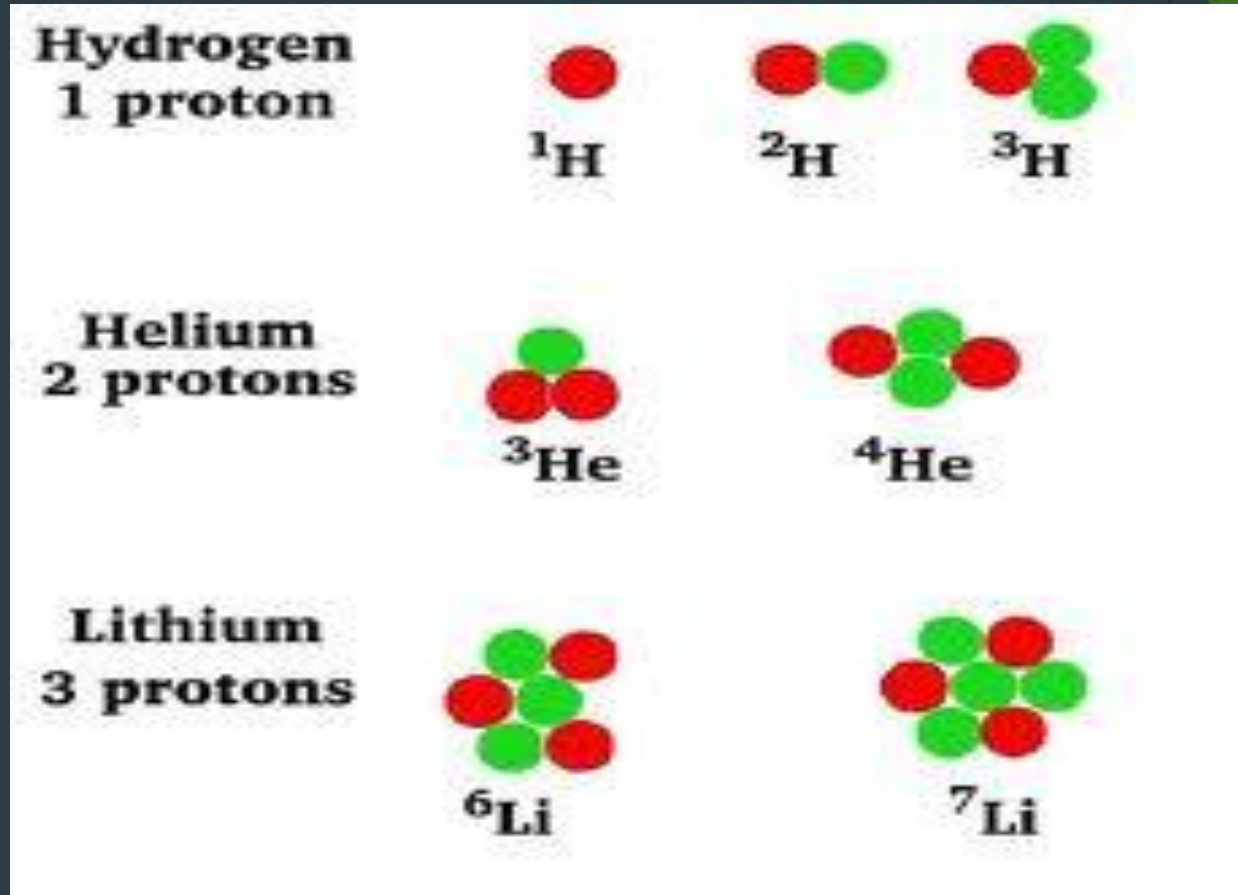
▶ More proton than electron, the atom is positively charged.

- **Octet Rule:** atoms tend to gain , lose or share electrons until they are surrounded by eight valance electron.

- Ex. Sodium atoms have 11 atoms, to be chemically stable should lose electron

# ISOTOPES

- Atoms with the same number of protons, but different numbers of neutrons.

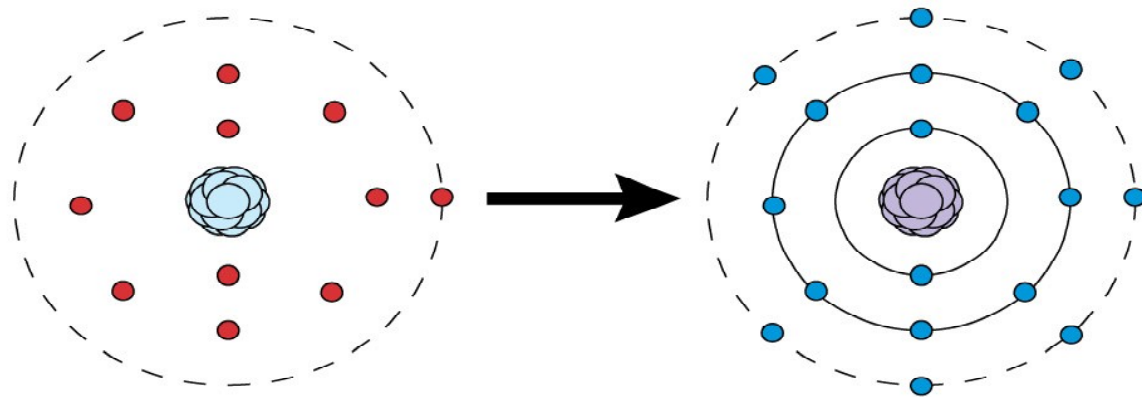


# *BONDING*

- **A compound** :is a substance that consists of two or more elements that are chemically combined in specific proportions.
- **Chemical Bonds** :are the forces that hold atoms together in a compound.

## Types of bounds

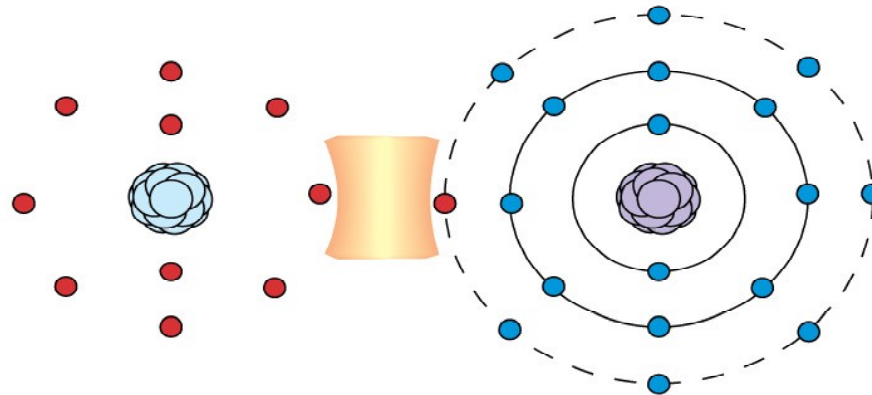
- ▶ **1- ionic bonding:** occurs between elements on opposite sides of the periodic table
  - Atoms gain or lose outermost (valence) electron to form ions (positively and negatively charged atoms).
  - Ionic compounds consist of an orderly arrangement of oppositely charged ion
  - ionic bound: the attraction of oppositely charged ions to one another.
  - Occurs between metal and nonmetal



Sodium atom  
loses 1 electron

Chlorine atom  
gains 1 electron

Reaction



Sodium ion  
 $\text{Na}^+$

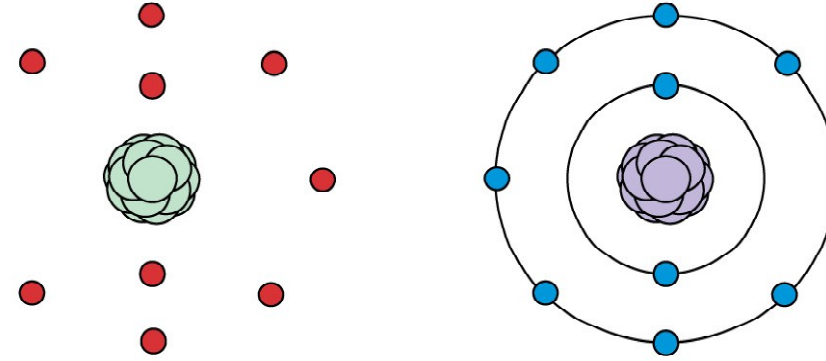
Chlorine ion  
 $\text{Cl}^-$

Compound sodium chloride forms by  
electrical attraction between  $\text{Na}^+$  and  $\text{Cl}^-$

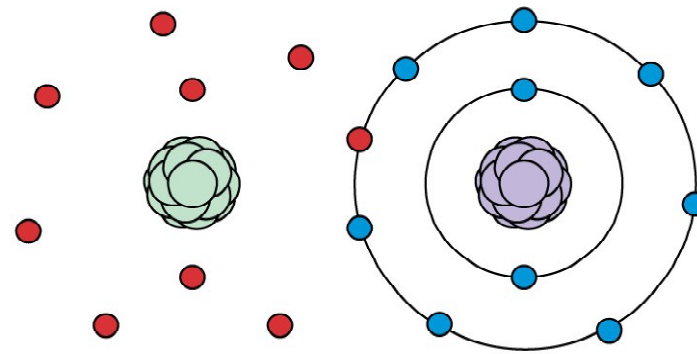
## ► 2-Covalent bonding

Atoms share a pair of electrons

-occurs between either same elements or with very similar properties(nonmetal and nonmetal)

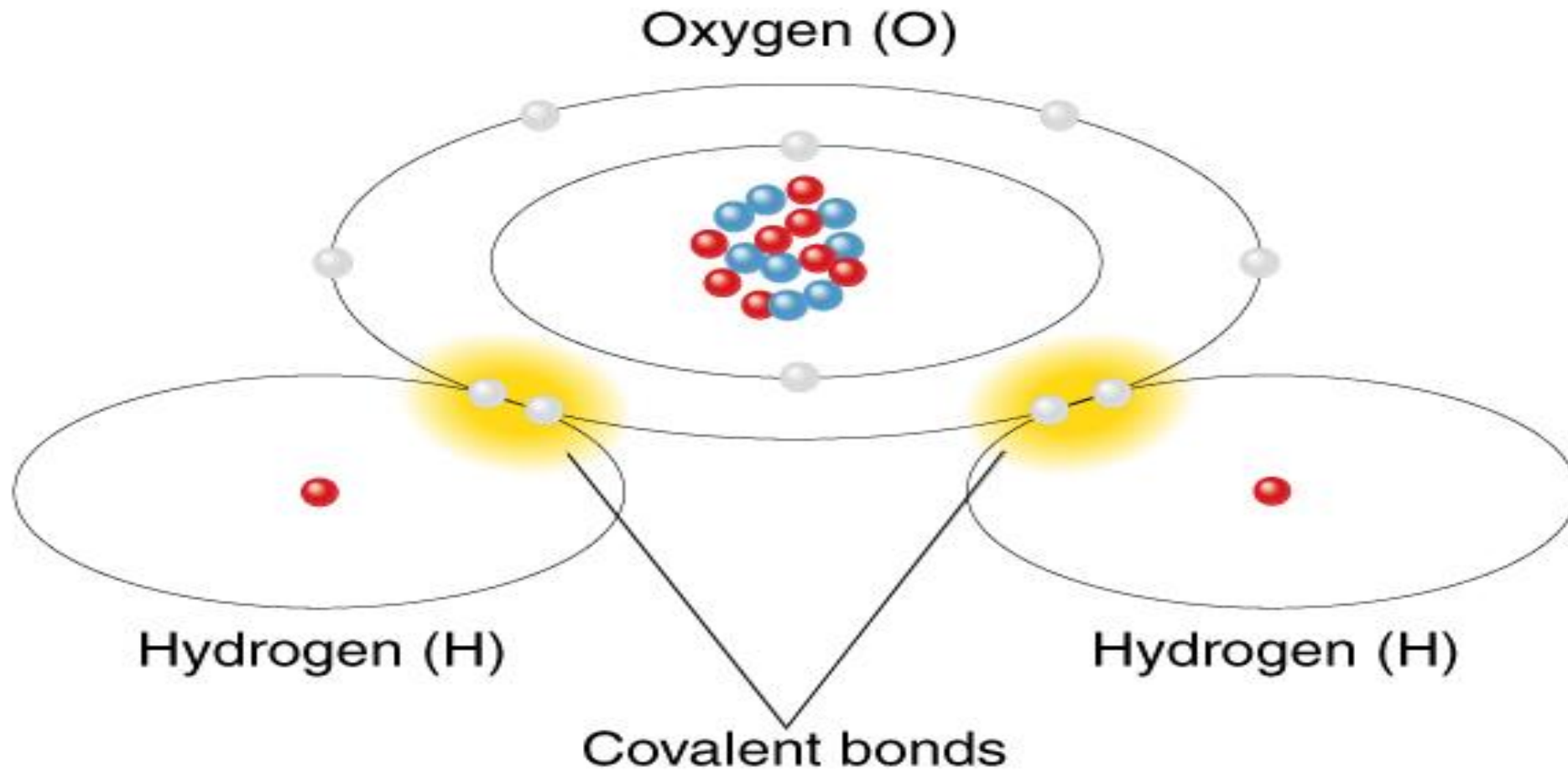


Reaction

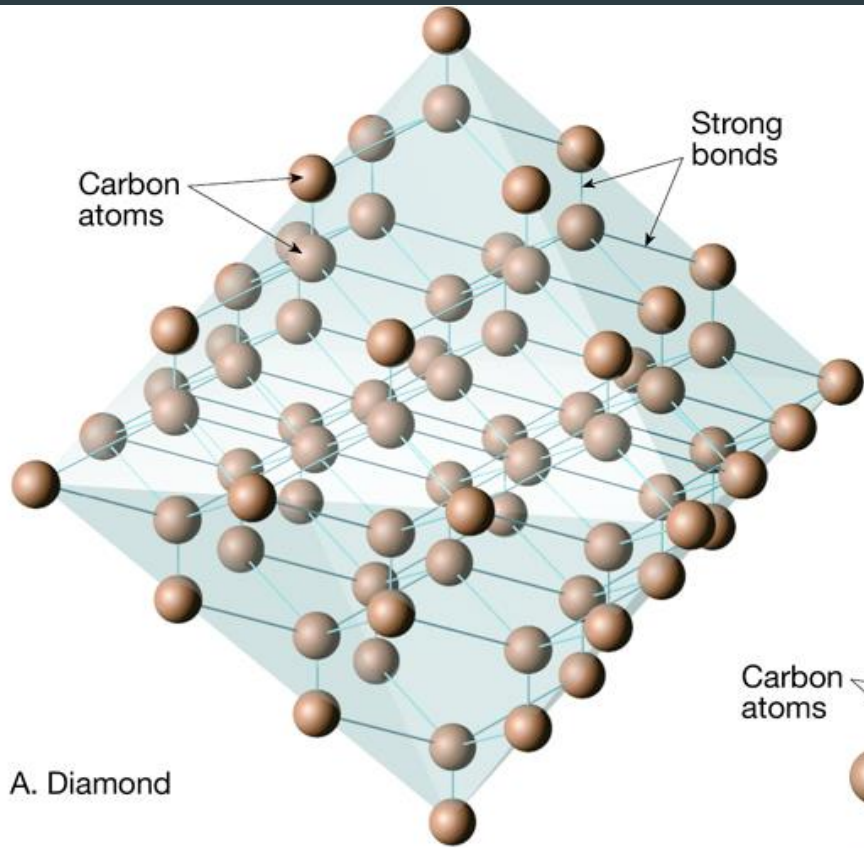


Covalent bond forms by sharing electrons

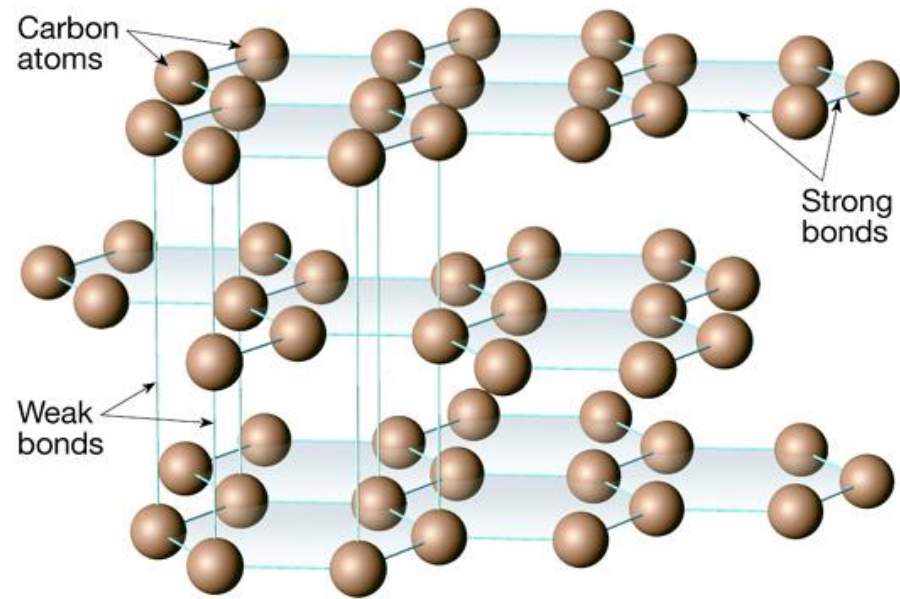
# Covalent Bonds in Water sharing electrons between atoms







A. Diamond



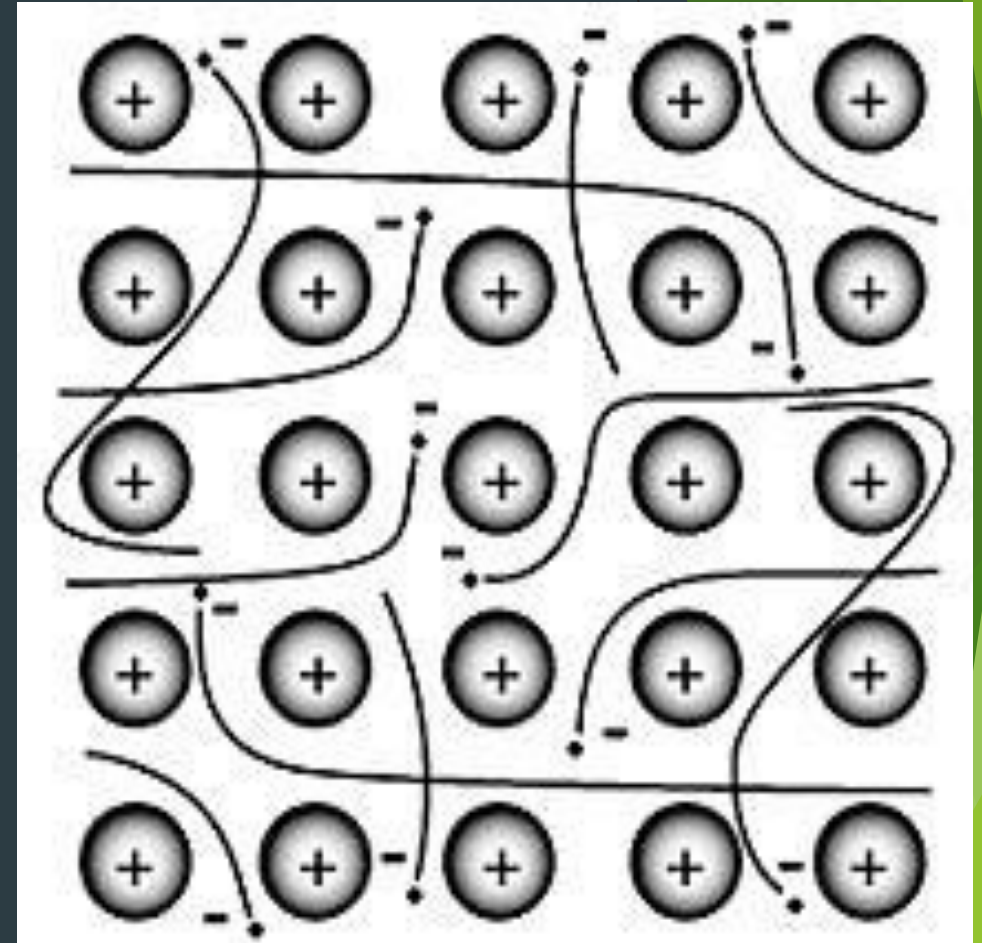
B. Graphite

# *Structure of minerals*

- Polymorphs
  - Minerals with the same composition but different crystalline structures
  - Examples include diamond and graphite
    - » Phase change = one polymorph changing into another

## 3-Metallic bonding

- ▶ Valance electrons are free to migrate among atoms.
- ▶ Account for the luster , malleability high electrical conductivity of metal.
- ▶ Sharing of electrons between metal ions
- ▶ Occurs between Metals and Metals



## *4-Hybrid bounds (covalent + ionic...)*

- ▶ Many chemical bound are actually hybrids that exhibit some degree of electron sharing and some degree of transfer.
- ▶ **Van der Waals** in graphite and other sheet silicate is like a static charge.



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